Feasibility Study for the development of a Water and Wastewater Innovation ‘Park’

Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean

Feasibility Study for the development of a Water and Wastewater Innovation 'Park'

Final Report

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Scottish Enterprise
The Scottish Government
SEPA Scottish Environment Protection Agency
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Scottish Water

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Water and Wastewater Innovation Park – Statements of Endorsement

"Dryden Aqua have recently started to supply Bangladesh with small water treatment systems, and the issues that are now emerging as a result of working in partnership with our customers highlights how a 'Hydro Nation' Innovation water research facility could facilitate not just small one -off solutions, but solutions for the whole of Bangladesh and indeed other developing nations. The Innovation report suggested that any such facility could generate £5 to £10 million per year, but such a facility could reality help support many billions for the Scottish economy by acting as a facilitator and bridge".

"At Biomatrix Water Solutions our advantage requires efficient technology development cycles and an innovative approach to solve problems providing new types of water management solutions in a highly competitive global water market. A water innovation park at which we can showcase our technologies would be a huge step forward in terms of securing Scotland's place on the map for water technology and would help us to accelerate technology innovation and commercialisation time scales to strengthen and grow the water sector in Scotland."

EXECUTIVE SUMMARY

The purpose of this report is to investigate the feasibility of creating a water and wastewater innovation 'park' or wider facility in Scotland.

The water sector is central to many of the fundamental components of a developed society yet, for various reasons, innovation has not progressed as quickly as many of those involved in the sector, particularly small and medium sized organisations (SMEs), would have liked.

We have mapped the current water and wastewater innovation landscape, both in Scotland and internationally. This shows that there is great deal of existing and planned activity that needs to be taken into account when developing this opportunity. We have also consulted with a large number of stakeholders from the SME, research, policy and other sectors. This work clearly identified that ***there is considerable enthusiasm for a Scottish facility*** and that this could be beneficial across all sectors.

Furthermore, ***there is a strong economic case*** for filling this gap. Based on our stakeholder engagement and evidence from existing facilities around the world, we estimate that a facility could readily generate in the region of £5 million to £10 million per year. In addition, an innovation facility could help deliver ***a range of wider benefits to the Scottish economy***, including jobs, competitiveness, an enhanced skills base and environmental improvements, including carbon reduction.

There is generally a clear consensus on the role that a facility should play and the attributes that it should have. For example, the key activities that it would be appropriate for an innovation centre to address include:

1. Co-ordination to develop the opportunity;
2. Improving communication and visibility of Scottish expertise and activity;
3. Developing the export market;
4. Developing the Scottish market; and
5. Supporting product innovation.

There are a number of practical steps that can be taken to enable the delivery of the facility. These are discussed within the report.

Our recommendations are summarised in Table (i). Unless otherwise noted these are annual costs and include the associated estate and overhead costs.

Table (i): Summary of recommendations and potential costs

Recommendation		Resource	Cost estimate
1	We recommend that a water and wastewater innovation facility in Scotland, aimed at filling the gaps identified in this feasibility study, is justified and should be progressed. It should be focused on addressing current and future water management challenges, at home but also internationally, using a set of strategic outcome-focused objectives to direct and support innovation effort towards integrated approaches that are well co-ordinated in technical, regulatory and commercial terms between the various actors across the sector.	In-house decision	£0k

Recommendation		Resource	Cost estimate
2	We recommend that the concept of developing a brand new physical facility is not progressed at this stage on the basis that it would be difficult to justify economically. However we propose that a detailed business plan is prepared with cost-benefit analysis of investment options to extend one or more existing facilities to address the gaps identified in this feasibility study, along with potential funding streams to support a 'hub and spoke' type of approach.	One-off	£50k
3	A water and wastewater innovation steering group should be created. Membership should be finalised once the aims and objectives of the facility are agreed, but could include the Scottish Government, Highlands and Islands Enterprise, Scottish Enterprise, Scottish Development International, Scottish Environment Protection Agency, Scottish Water and industry, together with representation from the commercial and university sectors.	In-kind support	£5k
4	Consideration should be given to this steering group being independently chaired by someone with the vision and credibility to link together the various elements of the facility and the various stakeholders, needed to ensure it will meet its strategic objectives.	Chair plus office support functions	£100k
5	The proposed steering group should consider an appropriate "brand" name for the facility, such as the acronym "WInS" (Water Innovation Scotland). It should coordinate a campaign to communicate the objectives of the facility and the creation of promotional material including leaflets and a web site.	Full-time appointment	£50k
6	Once established, the steering group should devise some appropriate metrics and targets to help demonstrate progress in achieving the facility's objectives over time.	Full-time appointment	£50k
7	The proposed steering group should increase the profile of water and wastewater infrastructure by seeking its inclusion at the sector level within the Scottish Development International "Smart Exporter" Scheme.	Part-time appointment	£25k
8	The proposed steering group should oversee the creation of a network of tier 1 water users within Scotland, working jointly under a common vision to develop and promote innovation in the supply chain.	Part-time appointment	£25k

Recommendation		Resource	Cost estimate
9	The facility should seek to actively influence funding at national and European level to reflect its priorities, and its activities should include a R&D grant support service that "dove-tails" with the existing services offered by Scotland Europa and the enterprise organisations and that provides practical assistance and access to financial support.	Full-time appointment	£50k
10	The facility's activities should include a product verification support service; and the facility should work towards becoming a licensed certifier of compliance with internationally agreed standards.	Included in 9 above	
11	The facility's activities should include an Intellectual Property protection service that draws on or supplements that already provided by steering group members.	Included in 9 above	
12	The proposed steering group should consider the use of a Scottish Water site (or sites) as a demonstration site and promote a collaborative 'low risk' approach to testing.	One-off	£50k
13	The proposed steering group should consider how existing databases and related activities could be expanded or improved to include all laboratory and testing facilities across the whole Scottish higher education sector and beyond.	One-off	£30k
14	The proposed steering group should consider recommending to the Scottish Funding Council that the creation of a Water Innovation Centre be included within their next call for proposals.	Includes cost of undertaking research.	£500k

Contents

1. INTRODUCTION

1.1. Background

For some time, the possibility of a water and wastewater innovation 'park' or wider facility in Scotland has been attracting interest and gaining traction[1]. Advocates range from the top echelons of government through to small and medium sized organisations at the cutting edge of innovation and developing new technology in the sector.

There is great potential to unite all of those with an interest by the exciting possibility of Scotland becoming a world leader in an area where its natural and economic advantages are apparent. Aside from its increasingly efficient and highly regarded water and wastewater infrastructure, Scotland has a number of existing technological or research establishments working in the water management area. Amongst over three hundred companies actively operating in a well-developed and diverse water sector, there is a strong capability in 'Tier One' organisations and R&D intensive small and medium sized enterprises (SMEs) and universities, many of which have established world class reputations overseas. Water and wastewater services are crucial to many of Scotland's key industries and sectors, including oil and gas, tourism, agriculture, aquaculture, chemicals and renewable energy. Government support (evidenced by the Hydro Nation agenda) and a well-developed stable political and regulatory system, accompanied by a relatively compact geographical area and a temperate climate complete the picture.

A driver for an innovation facility comes from the specific needs of the sector in Scotland, such as effective water management. As similar facilities in other countries have addressed the specific needs of that country, Scotland will need to do the same to identify its differentiator in the international market.

A number of workshops and reports have been held or undertaken recently which have highlighted the potential need for an innovation 'park' for water and wastewater technologies. In particular, a report undertaken by the Scottish Environmental Clean Technology Partnership explored how the economic benefits of this sector could benefit the Scottish economy, and concluded that this 'park' or facility could be key in accelerating the commercialisation of new technologies for use in both the domestic and overseas markets.

Against this background, MWH and Heriot Watt University were commissioned by Highlands and Islands Enterprise (HIE), as lead agency on the Environmental Clean Technologies Partnership water workstream, to undertake a feasibility study into an innovation park. The project steering group consisted of representatives from Highlands and Islands Enterprise, Scottish Enterprise, Scottish Environment Protection Agency, Scottish Government and Scottish Water (see Appendix 1). This report sets out our approach, findings, conclusions and recommendations. It will be of interest to a wide audience and should be a valuable contribution to this important debate.

1.2. Aim and objectives

The aim of the project is to "*assess the demand for an Innovation Park and consider if there are any barriers to fully realising the economic opportunities of the water sector for Scotland that could be addressed by a virtual and/or physical facility*".

[1] See for example Isle Utilities (2012) Realising the Economic Benefit of the Water Sector and KTN (2008) Energy Efficient Water and Wastewater Treatment.

Specific objectives are to:

1. Comment on possible location/hosts, funding and ownership/structure of the facility;
2. Provide a segmented map of Water R&D activity across Scotland;
3. Derive a potential demand profile (users and funders) for a Scottish based facility;
4. Assess the gap in the provision of Scottish innovation and R&D testing facilities for the water and waste sector; and
5. Identify the opportunities and constraints such a facility might face.

1.3. Methodology and stakeholder engagement

Our approach to this project has, to a large extent, been based around a review of relevant facilities in Scotland and around the world, supported by engagement of key stakeholders. The two main aspects of this engagement were:

- A stakeholder questionnaire directed at and tailored to policy, academic and SME audiences. These were sent by email to all contacts identified and agreed by the Project Steering Group. Key contacts were also followed up with telephone calls by the project team. The questionnaires are included in Appendix 2.
- Two stakeholder workshops, in Dundee on 20 August and Glasgow on 21 August, both hosted by a facilitator selected by HIE. These provided the project team with a broader and deeper understanding of the key issues, hopes and concerns of a smaller, but nonetheless important, set of stakeholders. Again, key stakeholders were invited by email and telephone. The workshop report is included in Appendix 3.

In addition, we spoke with many of those involved in existing facilities in the UK and worldwide, in order to identify the opportunities (including demand) for and barriers to creating a facility in Scotland.

1.4. Report structure

In Section 2, we outline the ***context for, and drivers of, innovation*** in the water and wastewater sectors.

In Section 3, we ***map the current water and wastewater R&D landscape*** in Scotland, in the rest of the UK, and in the rest of the world. Comparing this to the needs described in Section 2, we consider the extent to which there is a gap and the demand for filling it.

In Section 4, we provide more detail on the ***size of the gap and scale of the opportunity*** for Scotland. We consider evidence from existing facilities around the world that can be drawn upon to build the economic case for the facility. We also outline the possible options for developing a facility.

In Section 5, we set out, based on our work and discussions throughout this project, our view on the ***role of the facility***. This includes the different stakeholder groups that could be catered for and the services that could be offered.

In Section 6, we consider the ***practical elements*** of establishing a facility. This covers the physical, organisational and other characteristics that need to be considered. It also includes potential funding arrangements.

Throughout the report, we make ***recommendations*** regarding potential next steps. Along with our key conclusions, these are brought together in Section 7, which also includes broad cost estimates for the recommendations.

Note on terminology: The term 'facility' is used in this report where a wider interpretation of the concept is intended than may be implied by the term 'park', which some readers may interpret to mean a single physical location. Whilst a single physical park is discussed, the term 'facility' is inclusive of a range of options.

2. THE NEED FOR INNOVATION

The water sector is central to many of the fundamental components of a developed society – encompassing the provision of clean drinking water, wastewater services, environmental enhancement, resource efficiency, the affordability of basic services, water security and investment in large-scale infrastructure programmes.

The evidence of an increasing awareness of the importance of and focus on water and wastewater across the world is not hard to find. Improving access to water and sanitation is one of the Millennium Development Goals[2] and the UN now recognises that such access is a basic human right. A major recent study[3] highlighted four megatrends that are shaping the development of the water market:

- Population growth;
- An ageing infrastructure;
- Higher standards for water quality; and
- Climate change.

In Scotland, there are specific drivers related to these trends that intensify the need for innovation in the sector.

Box 1 provides a snapshot of what is meant by 'innovation' in this context. Most prominent is the Hydro Nation agenda, but they also include implementation of the Water Framework Directive (WFD), the Climate Change (Scotland) Act (which aims to reduce greenhouse gas emissions by 80% by 2050) and increasing demand for water and wastewater services from a range of sectors.

Box 1: What is innovation?

Innovation is the development of value through solutions that meet existing, unarticulated or new needs in new ways. It can be accomplished through different or more effective products, processes, services, technologies, or ideas that are readily available to markets, governments, and society. In the water and wastewater sector, innovation can take many different forms, for example a new piece of treatment technology (e.g. membrane treatment systems to meet drinking water standards in rural environments), a new process (e.g. supply chain contract incentives), linking sectors in new ways (e.g. low carbon wastewater treatment solutions) or new ways of working with customers (e.g. to promote resource efficiency). Innovation can be promoted in many ways, such as through dedicated research facilities, the development of Intellectual Property (IP), funding or competitions to 'solve' a problem.

Scotland is renowned for its water. Its lochs and rivers provide sources of wholesome drinking water, habitats for wildlife, resources for farming and industry as well as leisure and recreation. Maintaining these resources requires careful management and Scotland has made very significant investment in recent years, in particular to improve water supply

[2] http://www.un.org/millenniumgoals/
[3] SAM (Sustainable Asset Management) 2007, Water: A Market of the Future http://www.nedwater.eu/documents/Water%20a%20market%20of%20the%20future%20-%20Sam%20Robeco%20December%202007.pdf

services and protect the water environment. This has driven many examples of successful innovation, in areas such as treatment technology, infrastructure performance and catchment management.

Scotland's WFD river basin management plans have identified a range of significant water management issues; successfully addressing them will require significant technical, regulatory and commercial innovation from Scotland's water sector. The river basin management plan for the Scotland river basin district[4] highlights that:

> *"A large proportion of the waters of the Scotland river basin district are of high quality. However, around 35% are under significant pressure from human activity and are not in good condition … This plan outlines actions that need to be taken to improve such waters whilst protecting those that are already in good condition… Realising the goals of this plan will be a challenging and demanding task"* (p3).

Alongside this, public and private water sector organisations have a continuing need to deliver improvements in the water services they provide to customers and wider society.

Some of the challenges include:

- Balancing supply and demand – ensuring sufficient water of appropriate quality is available in the right places for those who need it, whilst recognising the changing patterns of demand and the need for resilience in the face of future climate change;
- Delivering resource efficient water supply and wastewater treatment – meeting the needs of urban centres, industry and agriculture in ways that cost-effectively minimise the use (and maximise the recovery) of energy, chemicals and other resources whilst meeting legislative and regulatory requirements;
- Affordability – ensuring water services are affordable and equitable for all water users and will continue to be so in the future in the face of economic uncertainty;
- Catchment management – devising adaptive catchment level approaches that deliver multiple and maximum benefits making best use of nature's own systems for managing water flows, water quality and ecosystem services;
- Managing the water-energy nexus – maximising economic and social benefit at local, catchment and national levels will increasingly depend on integrating the management of water with the management of energy and other resources;
- Resilience to flooding and drought – given the severe impacts that these events have on Scotland's people, property and infrastructure, Scotland needs to continue to innovate to increase its resilience to the increasing frequency and severity of flood and drought events.

Addressing these and other challenges will require 'systems-level' approaches, which in turn need much more co-ordinated and collaborative approaches between the public and private sector, between water users and land managers, between service providers, regulators and the supply chain. We need to develop a culture that directs innovation effort towards identifying, modelling, testing, monitoring and then promoting new solutions on the basis of evidence of their success in meeting these challenges.

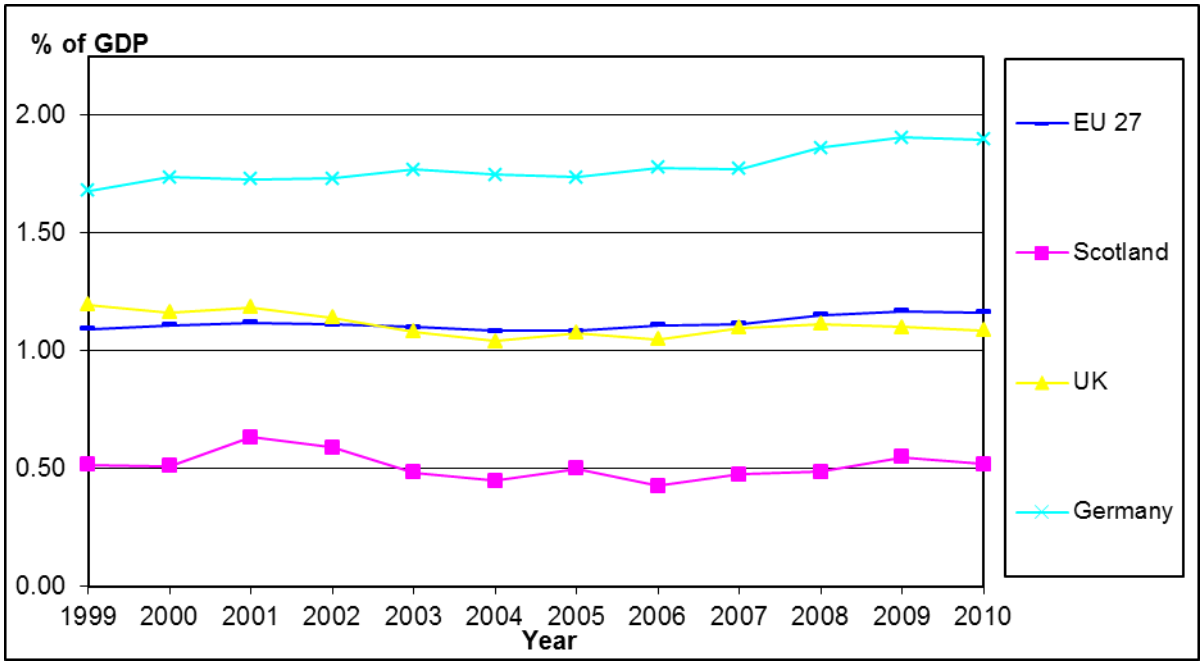
[4] The river basin management plan for the Scotland river basin district 2009–2015 published by the Scottish Government.

Doing this will not only help ensure we can best manage our water for the benefit of Scotland but success at home will also provide a platform for showcasing our capabilities on the world stage.

As the global market for water and wastewater services demands ever safer, cleaner and cheaper solutions, many new market opportunities are expected to emerge. Scotland, with its know-how and experience, is well placed to capitalise on these opportunities. But time is often lost in developing and proving technologies and this can be critical in gaining competitive advantage. For example, SMEs (generally those with less than 250 employees) and academic institutions can wait months to access pilot test sites, slowing the process of getting products and services to market. Other commonly cited barriers to innovation in the sector include the cyclical nature of planning (e.g. Asset Management Planning), risk aversion, target-based regulation and a lack of skills.

SMEs represent a key sector in driving innovation. There are around 300,000 SMEs in Scotland, and they represent over 99% of enterprises, with a combined turnover of around £86 billion[5]. However, business R&D expenditure in Scotland is lower than in the UK and the EU as a whole (Figure 1). Scottish Business Enterprise R&D (BERD) expenditure was £622 million in 2010, representing 0.52 per cent of Scottish GDP.

Figure 1: BERD as a percentage of GDP 1999 to 2010



Adapted from *www.Scotland.gov.uk*, High Level Summary of Statistics Trends, Business, Enterprise & Energy

The 2009 Cave Review[6] assessed the scope for competition and innovation throughout the water and sewerage sectors and made a number of recommendations to increase the

[5] http://www.scotland.gov.uk/Topics/Statistics/Browse/Business/Corporate/KeyFacts (accessed August 30, 2012)
[6] Defra (2009) Cave Review, Competition and Innovation in Water Markets, http://archive.defra.gov.uk/environment/quality/water/industry/cavereview/index.htm

efficiency and sustainability of water use. Many of these recommendations have been taken forward by government and others, e.g. in recent draft Water Bills.

In addition, there are a number of other existing or planned initiatives underway that are helping to drive innovation in the sector. Some of these have developed during the lifespan of this project, demonstrating the very active and dynamic landscape around innovation in water and wastewater. Scotland is not yet fully engaged in all of these, so they present an opportunity for any innovation facility.

- The European Commission is currently promoting the European Innovation Partnership (EIP) on Water. This will support and facilitate the development of innovative solutions to deal with the various water challenges facing Europe and the world, as well as support bringing solutions to the market. One output will be the creation of around ten *Innovation Sites*, to be launched in 2013, aimed at identifying barriers to innovation and developing, testing and demonstrating activities, actions, prototypes and solutions. At its first meeting in September 2012, the Steering Group of the EIP on Water decided on the following priority areas of action and cross cutting:
  - The water-energy nexus
  - Water governance
  - Financing for innovation
  - Resource efficient urban water supply and wastewater treatment
  - Balancing supply and demand
  - Integration of rural water management and land-use planning
  - Water supply and sanitation for small rural communities
  - Best practices in industrial water management
- Closer to home, the Scottish Funding Council has recently launched a call for proposals for innovation centres, which could potentially be leveraged to support the innovation facility, whilst the Scottish Government has pledged to make Scotland a leading 'hydro nation'[7];
- A proposed National Innovation Accelerator for Water, by WRc. This was the subject of a recent consultation and WRc is planning to produce a detailed proposal in December 2012;
- A British Water Trade Visit to Qatar and Oman planned for November 2012 and involving a number of SMEs;
- A new European Regions Research & Innovation Network (ERRIN) working group on water, looking into opportunities linked to the EIP on water;
- The Water Supply and Sanitation Technology Platform, initiated by the EC in 2004 to promote coordination and collaboration of R&D in the water industry. This has sought to integrate the needs of policy, SMEs, industry, research organisations and others under a number of strategic themes;
- The Technology Strategy Board, including its work with research councils and competitions (most recently on water security), Knowledge Transfer Networks and Small Business Research Initiative for procurement;
- Acqueau, which promotes innovation and market driven solutions to develop new technologies in the European water sector;

[7] Scotland – The Hydro Nation: Prospectus and Proposals for Legislation, Scottish Government, 2012.

- The Water Innovation Network, which aims to drive innovation in the supply chain and encourage end-users to adopt innovative solutions that reduce water demand and effluent;
- The Water Industry Forum, an independent, not-for-profit business network; and
- The Water Sector Innovation Leadership group, convened by Ofwat and including senior representatives from across the sector.

The range of initiatives suggests that it not easy for SMEs and others to identify where best to look for support for promoting and implementing their innovations.

3. WATER AND WASTEWATER INNOVATION TODAY – GAPS IN SCOTLAND

We undertook an extensive review and gathered information to provide a snapshot of current activity in Scotland and other relevant international sites. This activity is summarised in this section, with further detail provided in Appendix 4 (Literature review).

3.1. Current water and wastewater R&D activity in Scotland

Table 1 shows the main areas of activity in which the twenty nine SMEs, which we identified as being particularly active in the water and wastewater sector, are typically involved. Of those SMEs surveyed, almost half are active in almost half of the activities mentioned. The most common activity is innovation (40%), followed by bioremediation (36%) and analysis expertise (30%). Just 9% of responding SMEs are active in securing or arranging funding. Seven specialise in only one activity and only two are involved in facilitation.

Table 1: SME Questionnaire responses – key activity areas

			activity														
	SME	web	innovation	bioremediation	analysis	wastewater treatment	process control	project management	waste/ recycling	technology	infrastructure	equipment	design	measurement	funding	facilitation	knowledge exchange	total
1	Albagaia	www.albagaia.com	1	1	1	1	1		1					1				7
2	Atlantic Water	http://atlanticwaterco.com	1			1	1			1								4
3	Biomatrix Water	www.biomatrixwater.com	1	1		1							1					4
4	Drydenaqua	www.drydenaqua.com	1	1		1				1								4
5	Ers remediation	www.ersremediation.com	1	1	1			1										4
6	remedios	www.remedios.uk.com	1	1	1					1								4
7	ross-eng	www.ross-eng.com								1	1	1	1					4
8	Scottish Bioenergy	www.scottishbioenergy.com	1	1		1	1											4
9	Aqua 21	www.aqua21.co.uk		1	1	1												3
10	Aqualution	www.aqualution.co.uk	1			1	1											3
11	g2innovation	www.g2innovation.co.uk	1					1					1					3
12	giltech	www.giltech.biz	1				1			1								3
13	h2ology	www.apsu-environmental.com							1		1	1						3
14	Soilutions	www.soilutions.co.uk		1	1				1									3
15	Terrenus	www.terrenus.co.uk		1	1				1									3
16	zws	zws.inforportal.co.uk		1	1					1								3
17	Abc fluid technology solutions	www.abcfluidtechnologysolutions.com									1	1						2
18	EnPrint	www.enprint.co.uk		1	1													2
19	Id systems uk	www.idsystemsuk.co.uk						1								1		2
20	M Power World	www.mpowerworld.co.uk	1			1												2
21	Osea water	www.oseawater.com			1		1											2
22	Space Monkey Design House	www.smdh.co.uk	1										1					2
23	Binn Farm	eco-partnerships.abertay.ac.uk							1									1
24	Cairngrom National Park	www.cairngorms.co.uk													1			1
25	IRRI	www.irri.org.uk							1									1
26	Sarco Stopper	www.sarcostopper.com										1						1
27	Scotland Food & Drink	www.scotlandfoodanddrink.org														1		1
28	Strathkelvin	http://strathkelvin.com												1				1
29	Sunamp	www.sunamp.co.uk								1								1
			12	11	9	8	6	3	6	7	3	4	4	2	1	2	0	

Table 2: Key characteristics of a selection of innovation facilities

	Hub facility	Distributed facilities	Local authority participation	Academia participation	Industry participation	SME participation	Network of partners	Demonstration and testing	International accreditation	EU funding	State funding	Private funding	Seed funding for users	Fee structure for use	Consultancy	Graduate schools	Specialist advice	Funding expertise
Water Alliance (Netherlands)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y				
Energy Technology Partnership (Scotland)	Y	Y		Y	Y	Y	Y			Y	Y						Y	
Water Science Alliance (Germany)	Y	Y		Y	Y			Y			Y					Y	Y	
Water Resources Research Centre (USA)	Y	Y		Y		Y					Y						Y	Y
Centre for Water Research (Australia)	Y	Y		Y							Y							Y
Water Research Centre (WRc)		Y			Y		Y	Y	Y						Y			
UK Water Industry Research (UKWIR)				Y	Y		Y					Y						
Hydraulics Research (HR) Wallingford	Y							Y				Y			Y		Y	
Centre of Expertise for Waters (CREW)				Y			Y				Y				Y		Y	Y
Edinburgh Centre for Carbon Innovation				Y			Y								Y		Y	
Scottish Environmental Technology Network	Y					Y	Y	Y					Y					Y
Water Innovation Park (WIP), India	Y			Y	Y	Y	Y	Y										
Waterfronts, Israel				Y		Y	Y	Y					Y					

3.2. Comparable facilities in Scotland and internationally

There are a wide range of facilities in Scotland and further afield. Key characteristics of the most relevant of these are summarised in Table 2 and described below. Appendix 4 provides more detail around the mission, structure, facilities and funding arrangements for these facilities. This analysis provides a snapshot of current activity in Scotland and other relevant international sites which are engaged in activities that are similar to those of the proposed facility.

It is clear that existing facilities operate in a variety of ways and offer a mixture of services. There appears to be a number of relatively common attributes that could be applicable to a potential facility in Scotland.

- The most successful facilities seem to operate in a geographically distributed hub-and-spoke manner;
- Some offer specific or a variety of testing facilities, again often in a geographically distributed way;
- Some are involved in awarding grants for research or innovation prizes;
- Most have a broad expertise base and offer networking opportunities, often aimed at linking academic, industrial and SME partners;
- Only very few conduct international standards accreditation work;
- Funding generally comes from a variety of different sources, but the public sector frequently provides the majority of funding;
- Some are involved in linking water innovation activities to teaching and learning;
- Some are involved in the piloting or demonstration of innovative technologies or approaches; and
- Some have an anchor tenant (or tenants) around which other organisations cluster.

Water Alliance (Netherlands)

The most prominent example of a facility similar to that being considered in Scotland is the Water Alliance of Holland. This is a partnership of private and public companies, government agencies and competence centres involved in the water technology field. The relevance to this study is that it operates successfully as a geographically distributed physical hub-and-spoke facility; it contains a mixture of academic, industrial and SME participation; it has demonstration, testing and international accreditation capacity; it has broad expertise base which is self-contained; it has a complementary range of facilities at its disposal within its geographical footprint.

Participants in the Water Alliance include the water industry, various universities, SMEs, companies and organisations who are suppliers of applied water technology such as Landustrie, DMT, Paques, Philips, AquaExplorer and Dutch Rainmaker. It also includes regional authorities such as Leeuwarden and Sneek, Groningen and Drenthe, the Chamber of Commerce, Wetsus[8], and water companies such as Vitens. The research facilities cover

[8] Wetsus is a not-for-profit foundation located in Leeuwarden, The Netherlands. It is a centre of excellence for sustainable water technology and facilitates breakthrough innovations for water treatment technology.

laboratory, application and pilot plant demonstration scale, over sites spread across a diameter of about 30 miles. It is described as a 'European Water Technology Hotspot', including a wide range of 20 water companies and about 300 staff. It is due to complete its expansion in 2014, ultimately to employ 2,000 staff. The cost will be in the region of €35 million. The project is subsidised by funds from the Dutch and the European governments.

For participation in research themes, Wetsus charges €27,000 per year for each company, or €16,200 per year for those with an annual turnover under €3 million. Annual fees for involvement in research platforms (no voting right on the research platforms or entitlement to intellectual property) range from €3,240 for companies with turnover under €1.5 million to €10,800 for companies with turnover above €3 million. In total, there are 120 research projects under 24 research themes and 92 participating companies. Through these channels, companies contribute 25% of the total Wetsus budget, with the remainder coming from government, research grants or other sources.

Water Science Alliance (Germany)

The mission of the Water Science Alliance (WSA) is to create synergies between the different water research institutions in Germany in order to elevate the visibility of German water research on the national and international level as well as promoting young scientists´ careers. The relevance to this study is that it operates successfully as a geographically distributed hub-and-spoke facility; it contains a mixture of academic and other research institutes; it has broad expertise base which is self-contained; it has a complementary range of facilities at its disposal within its geographical footprint; it is operating successfully; it specialises in the exchange and rationalisation of techniques and practices. It comprises a distributed network of universities and other research institutions in the form of Thematic Clusters. These share research methods, have coordinated data management and monitoring, and share graduate schools which reduces costs and increases the variety of what can be offered. A range of facilities are covered from universities and non-university research institutions through the shared use of scientific and technical infrastructure and field research stations. The main funding sources are the Federal Ministry of Education & Research, and the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety.

Water Resources Research Centre (USA)

The mission of the WTC is to promote the understanding of critical state and regional water management and policy issues through research, community outreach and public education. The relevance to this study is that it operates successfully as a geographically distributed hub-and-spoke facility; it provides collaborative funding expertise and experience of successfully linking water innovation activities to teaching and learning. A university skill group drawing on 5 universities which also includes affiliated industrial practitioners of National reach. Distributed network of laboratories and spin-off companies spread across 5 universities within the State of Arizona. They receive State funding through the University of Arizona's Technology and Research Initiative Fund (TRIF). WRRC also is home to Arizona Project WET (Water Education for Teachers).

Wetsus' scientific research program is defined by the private and public water sector and conducted by leading universities. http://www.wetsus.nl/

Centre for Water Research (Australia)

The mission of the CWR is to promote understanding of the physical transportation mechanisms of waterways and to utilise this to maximise public benefit through achieving the highest achievable quality of drinking water. The relevance to this study is that it operates successfully as a geographically distributed hub-and-spoke facility but on a smaller scale; it provides international and mixed internal funding expertise. It is a public body with one central site and remote sampling stations. Research has been funded by Australian Research Council grants, water utilities, international funding bodies and research agencies, industry and private individuals.

Water Research Centre (WRc)

Their aim is to provide innovative and practical solutions to our customers in the water, waste and environmental sectors. The relevance to this study is that it operates successfully as a geographically distributed network of facilities; it offers testing facilities. The WRc is an independent and employee-controlled organisation. There are 3 main sites in England which between them cover Drinking Water Supply, Catchment Management, Wastewater Management, Sewerage, Waste & Resource Management, Monitoring & Control. Their main income is through consultancy fees. This would have particular value as a collaboration site. WRc recently proposed a National Innovation Accelerator for Water. This was the subject of a recent consultation and WRc is planning to produce a detailed proposal in December 2012.

UK Water Industry Research (UKWIR)

The UKWIR mission is to identify research requirements to meet the water industry's strategic business needs, procure the research competitively, and transfer the research outputs to contributors. The relevance to this study is that it operates successfully as a geographically distributed network of partners with no specific testing facilities; it can award grants for research. UKWIR is a member-based organisation and its members comprise 23 water and sewerage undertakers in England and Wales, Scotland and Northern Ireland. UKWIR has no dedicated research facilities: work is put out to tender. The majority of work is put out to open tender to a wide range of companies, academic institutions and other organisations in the UK and overseas. Project management is undertaken by both the water industry's R&D departments and by individuals employed by UKWIR. This would have particular value as a collaboration site.

Hydraulics Research (HR) Wallingford

The HR Wallingford mission is to build knowledge and solve problems, expertly and appropriately. The relevance to this study is that it has a wide range of specialised testing facilities and laboratories. HR Wallingford is a Private company. There is a single site with physical testing, physical modelling laboratories, and a full range of computational modelling tools. This would have particular value as a collaboration site.

Centre of Expertise for Waters (CREW)

CREW's mission is to connect research and policy, delivering objective and robust research and professional opinion to support the development and implementation of water policy in Scotland. The relevance to this study is that it operates successfully as a geographically distributed network of partners with no specific testing facilities. CREW is a partnership between the James Hutton Institute and all Scottish Higher Education Institutes funded by the Scottish Government. CREW is a referral network with no dedicated research facilities.

Their main income is through consultancy fees. CREW has a particular relevance to Scotland and the Hydro Nation agenda:

- Utilising Scottish expertise to maximise the economic benefit of water resources within a sound ecological context;
- Raising international profile through recognition of Scotland as an international leader on water management and governance; and
- Developing a water centre of expertise with international reach.

As such CREW has features that are consistent with the objectives of a facility for Water and Wastewater Innovation.

Energy Technology Partnership (Scotland)

The Energy Technology Partnership (ETP) of Strathclyde University in Scotland is a good example of a collaborative network, but in the field of energy. The relevance to this study is that it operates successfully as a geographically distributed hub-and-spoke facility; it contains a mixture of academic, industrial and SMEs; it has broad expertise base which is self-contained; it has a complementary range of facilities at its disposal within its geographical footprint. Membership includes a pool of 12 universities in Scotland, the Scottish European Green Energy Centre and the Scottish Energy Laboratory. The ETP is the largest power and energy research partnership in Europe, promoting collaboration between universities and industry to amplify R&D capability in a range of energy technologies. Like the Dutch Water Alliance, they employ specialist centres embedded in the existing regional partnerships and institutions. Funding of £3m comes from the European Regional Development Fund (ERDF), Scottish Government, Scottish Funding Council, Scottish Enterprise and ETP Member Universities. Studentships are available, as are technology transfer specialists and business managers and other facilitation staff, importantly, *at no cost to users*. This would have particular value as another example of a collaboration site.

Edinburgh Centre for Carbon Innovation

The ECCi mission is to create a hub for the knowledge, innovation and skills required to create a low carbon economy. The relevance to this study is that it operates successfully as a geographically distributed network of partners with no specific testing facilities; it is an example of a successful activity in an area different to water. The ECCi is an alliance of University of Edinburgh University, in partnership with Heriot-Watt University and Edinburgh Napier University. A referral network with no dedicated research facilities, but facilitation resources are available. Pooling the resources of member universities provides research capacity. Its main income is through consultancy fees.

Scottish Environmental Technology Network (SETN)

The SETN mission is to support the development and encourage the growth of the Environmental and Clean Technology (ECT) sector in Scotland. The relevance to this study is that it operates successfully as a single site; it can award grants for research; it promotes pilot-scale funding and leverage. The SETN was established as a separate unit in the Faculty of Engineering at University of Strathclyde in 2010. It has in-house laboratory facilities, including a wide range of environmental matrices including soils, waters, wastes and other materials, and space to undertake bench scale trials in an environmental laboratory. SETN Innovation Grants (SIGs) offer members the opportunity to engage in early stage R&D enabling projects to lead to larger investments in R&D. The scheme is

open to Scottish SMEs who are members of SETN. SETN is able to offer a grant of up to £5k which may be a maximum of 50% of the total eligible costs.

Water Innovation Park (WIP), India

This was set up to provide a platform for academia-industry interface, in the field of water technology research. It is a joint venture with Andhra Pradesh Industrial Infrastructure Corporation Ltd. (APIIC). The relevance to this study is that it has a wide range of specialised testing facilities and laboratories and has an anchor tenant. The WIP is a dedicated facility on the University of Hyderabad campus. Based on the model of a University-based R&D park this 20 acre site has a wide range of facilities aimed at providing clean water. They host BioAsia, an annual international biotech event assisting international water technology companies in creating new business partnerships, academic and industrial collaborations. It is currently in development and expected to be complete by 2015.

Waterfronts, Israel

This group actively encourages investors, Israeli academic research centres and private enterprises to create the right infrastructure for developing new, breakthrough systems designed for a variety of water functions. The relevance to this study is that it operates successfully as a geographically distributed network of partners with no specific testing facilities; it manages a large research and grant budget (500M USD). Starting in 2006, they now offer studentships, start-up grants and incubator initiatives. Waterfronts is a non-governmental organization. They operate as a referral network with no dedicated research facilities, but network across a range of national resources. Waterfronts dispenses a budget of approximately 0.8B USD per annum for start-up companies and R&D.

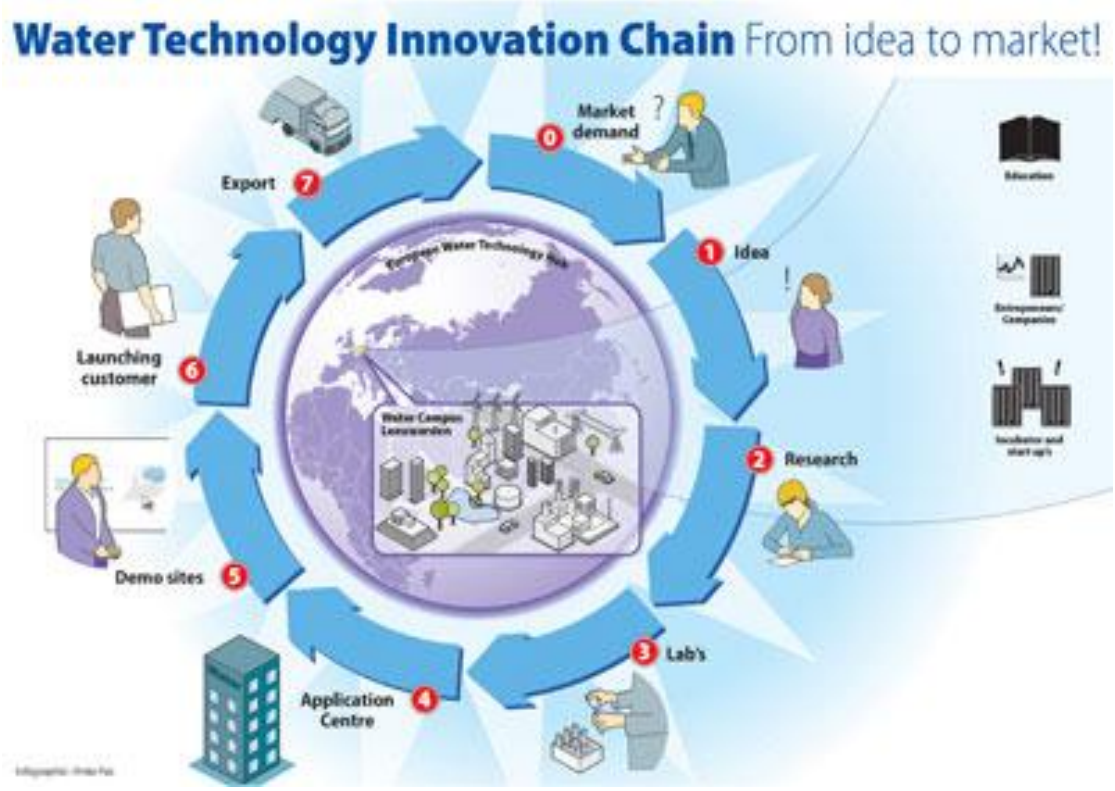
3.3. Conclusions of literature review

In conclusion, a range of organisations is actively promoting water related R&D, nationally and internationally. These can provide useful information with which to formulate the activities and arrangements for the proposed facility in Scotland. In particular, any such facility should:

1. Incorporate the best features of the examples outlined above;
2. Take account of the activities provided by existing facilities, and collaborate where appropriate; and
3. Promote the specific issues relevant to Scotland (i.e. in line with the Hydro Nation agenda).

From the material we have reviewed, the Netherlands Water Alliance provides an example of what could be achieved with a sufficient level of investment. The Alliance is a network organisation supported by co-location of key services on a single site. Financial support for the enterprise was provided by the Regional Government in the Netherlands with support from the EU Regional Development Fund. The first phase is already in existence and a second phase is planned to start construction in 2013. As indicated by Figure 2 below, the focus of the Alliance is very much on supporting innovation and product development by providing access to laboratory facilities, development and demonstration sites. Research and educational links are facilitated through the Westus Academy based in Leewarden. The academy is itself a collaboration between the Wageningen University, University of Twente and the University of Groningen.

Figure 2: Innovation at the Water Alliance



Like many of innovation centres discussed above, the Netherlands Water Alliance helps focus the efforts of the supply chain (including testing and demonstration of the capabilities of technology) on current and future strategic needs for water management, helping to drive research and technology development to provide solutions to these needs. This ultimately benefits the home economy through commercialisation of technology and service offerings, as well as creating a regional hub for international technology companies.

3.4. University expertise in Scotland

Of course, many of our universities are involved in water-related innovation, research and development. Table 3 provides a summary of relevant research expertise contained within the Higher Education sector in Scotland. There is a good fit between this and many of the areas that would be covered by an innovation facility, offering opportunities for collaboration and consolidation (a theme we return to in Section 6). For example, university involvement could be extended by the inclusion of interdisciplinary research activities such as, sensor, membrane technology and water chemistry.

Table 3: University research activities

Institution	Key water and wastewater research interests
Aberdeen	Remediation and attenuation of multiple pollutants, removal of contaminants from industrial wastewaters.
Abertay	Urban water technology, including sewer systems, design and operation of sewage overflows, SUDS, monitoring of sewage and sludge.
Dundee University	River management, including WFM, wetland ecosystems services, water policy and law.
Edinburgh	Institute for Infrastructure & Environment, interested in the development of integrated environmental solutions to inter-related topics in water supply, water quality, contaminated soil and groundwater.
Glasgow	Microbes for low energy sewage treatment, sustainable waste conversion with net bioenergy production, waste to biogas and other valuable chemical by-products.
Glasgow Caledonian	Water and wastewater treatment, advanced oxidation, nutrient removal and recovery from waste and eco toxicity assessment of micro pollutants.
Heriot Watt	Flood risk management, SUDS, urban water management, eco-systems services, building drainage, low energy wastewater treatment, water conservation standards.
Stirling	River ecosystem science.
Strathclyde	Hydrogeology, contaminated groundwater, sub-surface flow and pollutant transport, water and wastewater distribution systems.
University of the Highlands and Islands	The Scottish Association for Marine Science (SAMS), Oban; Environmental Research Institute (ERI), Thurso.

3.5. Summary of gaps and need for an water and wastewater innovation facility

In summary, there is a range of research in and activity around water and wastewater innovation – in Scotland, in the UK more widely and internationally. Some of this is directed towards addressing some of the water management challenges set out in Section 2. However, our mapping of the current situation indicates that there are a number of gaps that a dedicated innovation facility could fill, namely:

- Current innovation is uncoordinated, with no clear centralised structure or geographical focus;
- Innovation effort is not aligned with a co-ordinated set of water management objectives, which will help maximise benefit to the Scottish people, the economy and the environment;
- The range of existing initiatives and organisations involved in promoting innovation often frustrates progress;

- Incentives to promote innovation, including funding, is also disperse and frequently uncoordinated;
- There is no clear network or path for SMEs and other organisations to follow to bring their ideas to market; and
- Innovation is often sector focused and it is hard for industry, policy and academia to work together or across sectors.

In our view, there is a need and demand for a water and wastewater innovation facility in Scotland to address these gaps. This should build on existing processes and facilities across Scotland in an incremental and adaptive way.

Such a facility should be founded on a common set of strategic objectives, to direct the various groups operating in the sector towards co-ordinated approaches to addressing the water management challenges in Scotland and across the world. It could provide a 'one-stop-shop' for organisations, particularly SMEs, to develop, test and bring to market new water and wastewater technologies, products, concepts and solutions (Box 2). Importantly, it would also aid networking and facilitate more coordinated and user friendly access to information, research and funding.

Box 2: From inception to market

The Water Academy in Holland has several examples of getting ideas to market, including:

- The Water Business Challenge includes residential events that match ideas and concepts with industrial needs and sponsors, resulting in viable projects with competent management teams; and
- The Centre of Expertise Water technology, which has overseen a number of successes, including a project by Waternet to remove toilet paper from wastewater; the use by SR Technologies of worms to break down and improve fermentation of sewage sludge; and a bio-nanotechnology process by BiAqua that selectively removes phosphates from water, thereby preventing microbial growth and removing the need for toxic chemicals.

Source: http://www.wetsus.nl

Recommendation 1: We recommend that a water and wastewater innovation facility in Scotland, aimed at filling the gaps identified in this feasibility study, is justified and should be progressed. It should be focused on addressing current and future water management challenges, at home but also internationally, using a set of strategic outcome-focused objectives to direct and support innovation effort towards integrated approaches that are well co-ordinated in technical, regulatory and commercial terms between the various actors across the sector.

4. THE SCALE OF THE OPPORTUNITY

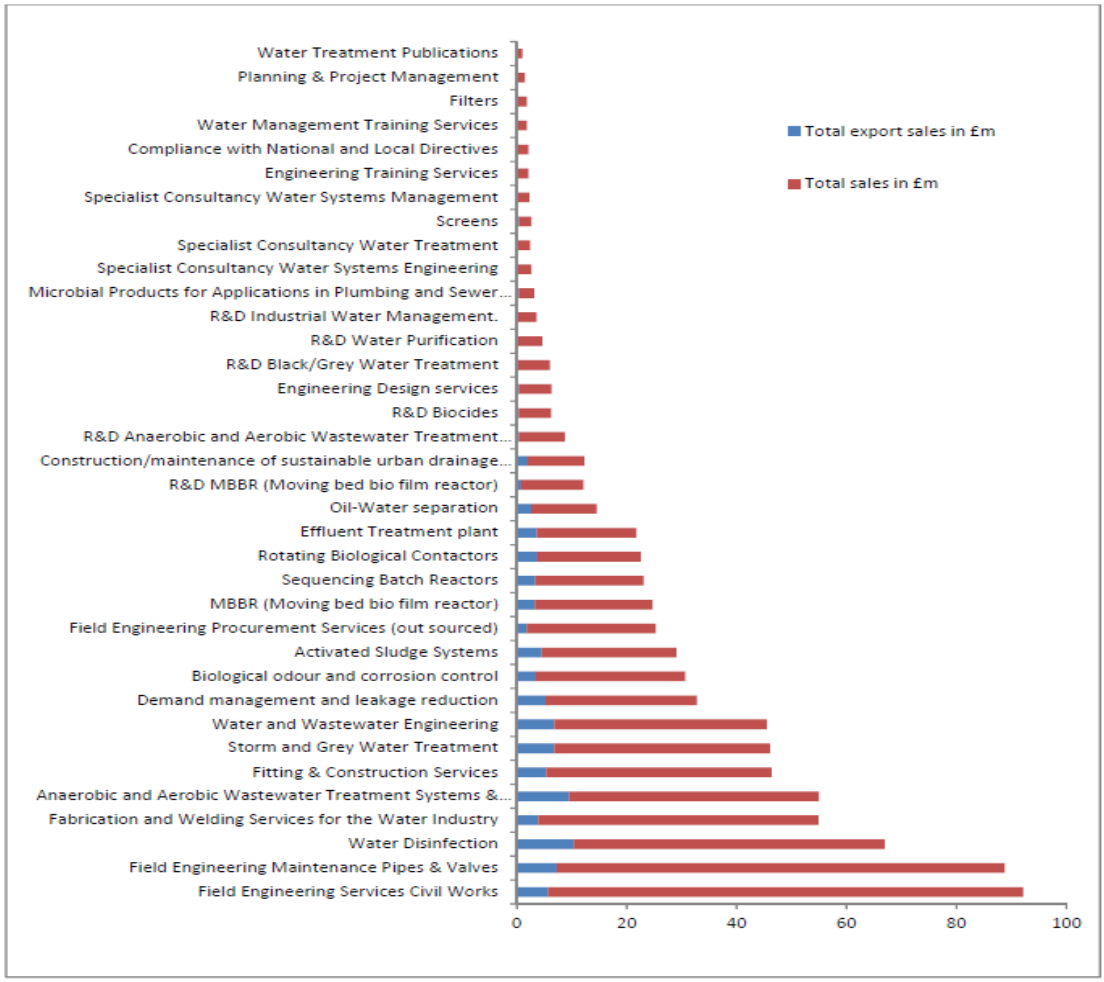
4.1. The water market globally and in Scotland

Globally, the current water market has been calculated to be worth US$480 billion, expected to grow to $770 billion by 2016. In 2009/10 the Technology Strategy Board (TSB) undertook a study to understand the magnitude and impact of water-related societal challenges in the UK and the opportunities for business innovation. The TSB calculated the UK water market to be worth around £12-14 billion per year[9]. About half of this is made up by consultants and private construction projects, with the remainder split between public sector or local authorities, highway authorities, developers, industry and agriculture.

The total revenue for the UK water supply and wastewater treatment sector is over £8 billion, with Scotland contributing just less than 10% of revenue. Scottish SMEs involved in water supply and wastewater treatment (this does not include hydropower sub-sector) comprise global sales of £709 million and employed 6,200 people in 2008/09.[10] Figure 3 below summaries the total sales and export sales across the subsectors within the water supply and wastewater treatment category.

[9] 2010 figure, reported in Isle Consulting (2012) Realising the Economic Benefit of the Water Sector
[10] Innovas 2011, Scotland Low Carbon and Environmental Goods and Services Sector Study

Figure 3: Summary of total sales and exports across water sub-sectors



4.2. Potential revenue for a water and wastewater innovation facility

Potential demand for a facility can be estimated using a number of methods:

I. Consultation with potential users

Results from the SME questionnaires indicate that organisations in this sector typically spend around 13 per cent of annual turnover on R&D. Of this, respondents stated that around 12 per cent could be spent in future accessing testing facilities. Extrapolating to all SMEs involved in the water and wastewater sector (total revenue £709 million) suggests that the potential revenue to the facility could be around £11 million per year.

Alternatively, extrapolating the amount that respondents implied they could spend accessing testing facilities to the 300 or so SMEs actively involved specifically in the water and wastewater sector suggests that the potential revenue to the facility could be around £4 million per year.

This range (£4-11 million) probably represents a conservative estimate for potential revenue because there are other potential users of the facility outside the SME sector (universities, public sector and large businesses) along with others outside Scotland. In addition, these estimates relate to the use of testing facilities only, which is only one (albeit an important one) potential element of the total service offering.

II. Existing R&D expenditure

A further figure for potential revenue can be calculated by applying the 12 per cent of R&D expenditure potentially spent accessing testing facilities to the BERD estimate of annual R&D expenditure in Scotland (£622 million, see Section 3), giving a figure of £75 million. This is likely to be an overestimate since it encompasses the R&D spending of all businesses, not just those involved in the sector. However, if just 5 to 10 per cent of R&D expenditure related to water and wastewater in some way were assumed (not unreasonable given its importance in all key sectors of the Scottish economy), this would still suggest annual revenue for the facility of between £3.75 and £7.5 million.

III. Demand for comparable facilities

A further estimate of potential revenue can be obtained by considering the revenues from those organisations working in similar areas and offering similar services. The revenue for some key comparable organisations is shown in Table 4.

Table 4: Revenue for comparable facilities

Organisation	Key services provided	Annual revenue
Wetsus	Water treatment innovation Research coordination Water technology network Demonstration sites Access to funding Workshops and conferences	£11.2 million[1]
WRc	Instrument testing and evaluation Certification Training Expert guidance	£6.7 million[2]
Agamim 10 (Israel)	Encouraging Academic Research, Industrial R&D & Professional Training Targeted investments Supporting Instruments and Activities	£12 million (approx.)[3]

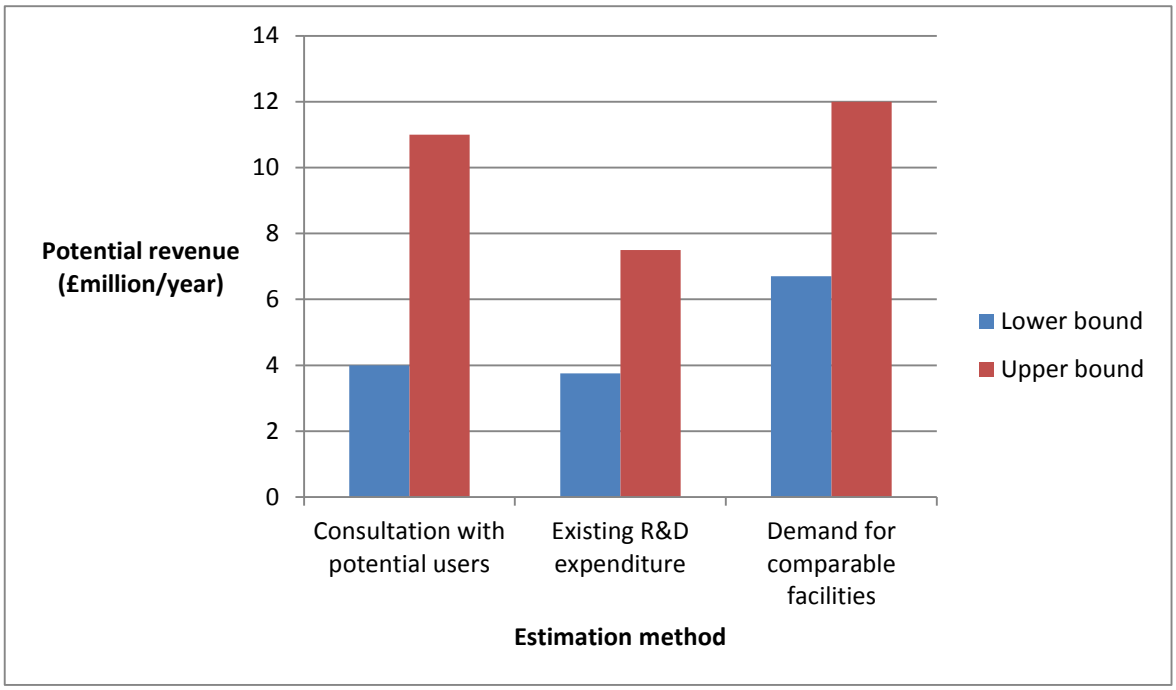
Notes:
[1] Annual report, 2012 (€1 = £0.8)
[2] Annual accounts, 2011
[3] http://www.waterfronts.org.il/services.html ($1 = £0.6)

Of course, it is only possible to provide broad estimates of revenue at this stage, since there are a number of factors which will impact upon the actual demand for a facility, and on subsequent revenues. The most important of these are likely to be:

- Services provided by facility (see options discussed under Section 4.4 and range of activities discussed in Sections 5 and 6);
- Whether the focus is primarily on the domestic or the (much larger) export market;
- Cost of using facility;
- Location and accessibility;
- Substitutes; and
- Income/revenue of potential users.

Figure 4 summarises the range of estimates of potential revenue for a facility in Scotland. Based on this analysis, the most likely estimate is in the range of £5-10 million per year.

Figure 4: Range of potential revenue for innovation facility in Scotland



4.3. Broader economic benefits

In addition to the potential revenues described above, there will be other important benefits associated with the facility that may not be fully captured by the operators but instead accrue to others or to society at large. It is not possible to fully quantify all of these at this stage but they should be considered and include:

- Employment. The facility would require a small core staff with responsibilities including strategy, policy, marketing and administration. In addition, jobs would be created in water and wastewater innovation and technology (a sector currently employing around 6,000 people in Scotland), with the extent of additional job creation linked to the success in achieving the facility's objectives. However, assuming a 10 per cent increase in employment in this sector, this would mean an additional 600 jobs;
- Competitiveness. The facility will contribute to an increase in Scotland's share (currently around £700-800 million per year) of the global water and wastewater market, currently worth in the region of £500 billion, and increasing rapidly. Again, assuming a 10 per cent increase in market share, this would be **worth £70-80 million per year to Scotland**;
- Skills development. Successful development of the facility would lead to increased demand for skills and associated training in a number of areas, including engineering, biochemistry, innovation, design and measurement. This would in turn have benefits for the higher education sector and for society more broadly; and
- Environmental benefits. Greater deployment of innovation and technologies is likely to lead to improved resource efficiency generally, and reduced pressure on environmental goods and services in particular. This will include energy efficiency

and renewables (leading to reduced greenhouse gas emissions), improved water quality (reduced pollution) and availability, reduced waste and benefits to ecosystem services.

4.4. Options for developing a water and wastewater innovation facility

There are a number of possible options for developing such a facility, in terms of location, hosts, funding and structure. The three main options we believe are feasible are described below. The options would require different levels of investment, which could come from either the public or private sector (or both). Costs are discussed further in Section 4.5.

Option 1 – Limited expansion of existing activities

Given the range of activity around research and innovation highlighted in Section 3, a credible option would be to do little more than seek to improve coordination of this work and to highlight how it could benefit the Scottish economy. Indeed, many of the key stakeholders in this area and project partners are actively engaged in just such activities, so this option would be easy and low-cost. For example, stakeholders could seek to maximise opportunities for collaboration with the Dutch Water Alliance, effectively becoming a Scottish arm of this existing network. The potential downside is that this approach may result in little tangible progress and the gaps outlined in Section 3 would remain. A small core team (perhaps two or three full-time equivalent staff) would be needed to provide these basic services.

Option 2 – Fully coordinated 'hub and spoke' facility building on existing assets

A more sophisticated option, that would address many of the gaps highlighted, would be to better utilise and coordinate existing assets, with a central 'technical hub' facility developed to provide a key set of core services and act as a focus for driving innovation. A number of 'spokes' (again using existing facilities wherever possible) could then be explicitly linked to the hub, enabling users to benefit from a range of services across a number of distributed sites. The hub could be a university, a Scottish Water site or another industrial or commercial site. The exact location and nature of the site could be decided by the Scottish Government, by a wider stakeholder group, or by competitive tender. The facilities and services that would need to be provided by any such site are explored in more detail in Sections 5 and 6. The 'technical hub' need not be at the same site as any administrative or office-based centre, which could act as a focal point for the facility. Indeed, there may be good reasons for keeping them separate, such as enabling the administrative functions to focus on strategy, promotion and co-ordination activities. A larger core team (perhaps five or six full-time equivalents) might be needed to support this option.

Option 3 – Create a new dedicated facility

The use of any existing site may encounter some (technical or other) challenges and require some investment, since it will not have been designed with the specific nature and functions of a dedicated innovation facility in mind. A further option is therefore to develop such a site from scratch, potentially combining the technical and administrative functions within a single site. Again, there are different options for the location, nature, structure and funding of such a site. These include the use of private capital in a public-private partnership. Whilst the construction of a new facility would offer obvious advantages in terms of 'showcasing' innovation in the water and wastewater sector to the world, the costs are likely to be significantly higher than under the first two options. As well as the capital costs, operating costs will likely also be higher than those of an existing facility, with perhaps ten or more full-time equivalent staff needed to run it.

4.5. The costs of creating a physical water and wastewater innovation facility

As discussed in Section 3, the Water Alliance could be an appropriate model on which Scotland could base the creation of its own water and wastewater innovation park. However, the construction cost of a bespoke facility would be significant, for example, the cost of the second phase of construction at the Westus Academy site is estimated to be 35 million euros, which is a similar level of investment required for the construction of the Edinburgh Bioquarter, a similar initiative in bio-medical sciences located at Little France and reported to have cost £24 million. Once built, a physical facility would also have on-going costs associated with its operation and maintenance.

As discussed in Section 3.2, a majority of the required funding would, initially at least, need to come from the public sector, although various sources of private finance and 'user fees' could also be explored. One particular avenue, mentioned by a number of stakeholders, is the Scottish Funding Council, which is currently examining proposals for a number of innovation centres.

Given the potential revenues highlighted above and the fact that Scotland already has a number of organisations and structures in place designed to support innovation, research and education in fields related to water and wastewater treatment, it is likely that a brand new single site investment is not appropriate in a Scottish context at the current time. This does not imply that much cannot be achieved within Scotland through investment in extending existing facilities and improving organisational structures. Indeed much could be achieved by improved co-ordination of existing activities to ensure visibility and coherence of the sector in Scotland. As part of this, an existing owner/operator could host a suitably arranged demonstration facility. This is discussed further in Sections 6 and 7. In any event, a more detailed business plan will be required to justify any major investment involving the extension or development of any potentially suitable existing facilities.

Recommendation 2: We recommend that the concept of developing a brand new physical facility is not progressed at this stage on the basis that it would be difficult to justify economically. However we propose that a detailed business plan is prepared with cost-benefit analysis of investment options to extend one or more existing facilities to address the gaps identified in this feasibility study, along with potential funding streams to support a 'hub and spoke' type of approach.

5. THE ROLE OF A FACILITY – ADDRESSING THE GAPS

5.1. What stakeholders want – questionnaire responses

A questionnaire was used to elicit the views of Scottish policy organisations, SMEs and university/research providers. The responses provide some valuable insights into what key stakeholders expect from a water and wastewater innovation facility. The questionnaire was sent to a wide range of organisations (Appendix 5). Despite follow up phone calls, the response rate was not very high; those who did submit responses are shown in Table 5.

Table 5: Questionnaire Respondents

Policy Organisations	SMEs	Universities and Research Providers
Highlands and Islands Enterprise	Biomatrix Water Technology	James Hutton Institute
Scottish Enterprise	Sarco Stopper Ltd	Glasgow Caledonian University
Scottish Government	Binn Eco Park / EcoIdeaM Ltd	Heriot Watt University
SEPA	Aqualution Systems Ltd	University of Aberdeen
WICS	Aqua21 Ltd	University of Dundee
HFS	Space Monkeys Design House (SMDH) Ltd	University of Glasgow
Water Supply and Sanitation Technology Platform	Dryden Aqua Ltd	University of Strathclyde
Drinking Water Quality Regulator	Albagaia Ltd	
Scottish Canals	EnPrint Ltd	
Water Industry Commission for Scotland		

Both SMEs and universities were asked to indicate the importance of the following activities in assisting with business development using scores from 0 to 5, where 5 indicates strong support.

- Access to testing and demonstration facilities to support product development;
- Product certification to demonstrate compliance with international standards;
- Facilitation of opportunities to increase export potential through networking and partnering with major engineering companies;
- Legal advice on protection of intellectual property;
- Facilitation of links with universities to ensure access to their research capability and provide intelligence on future product opportunities;
- Access to policy expertise; and
- Facilitation of access to third party funding to support research, i.e. EU and UK Research Councils.

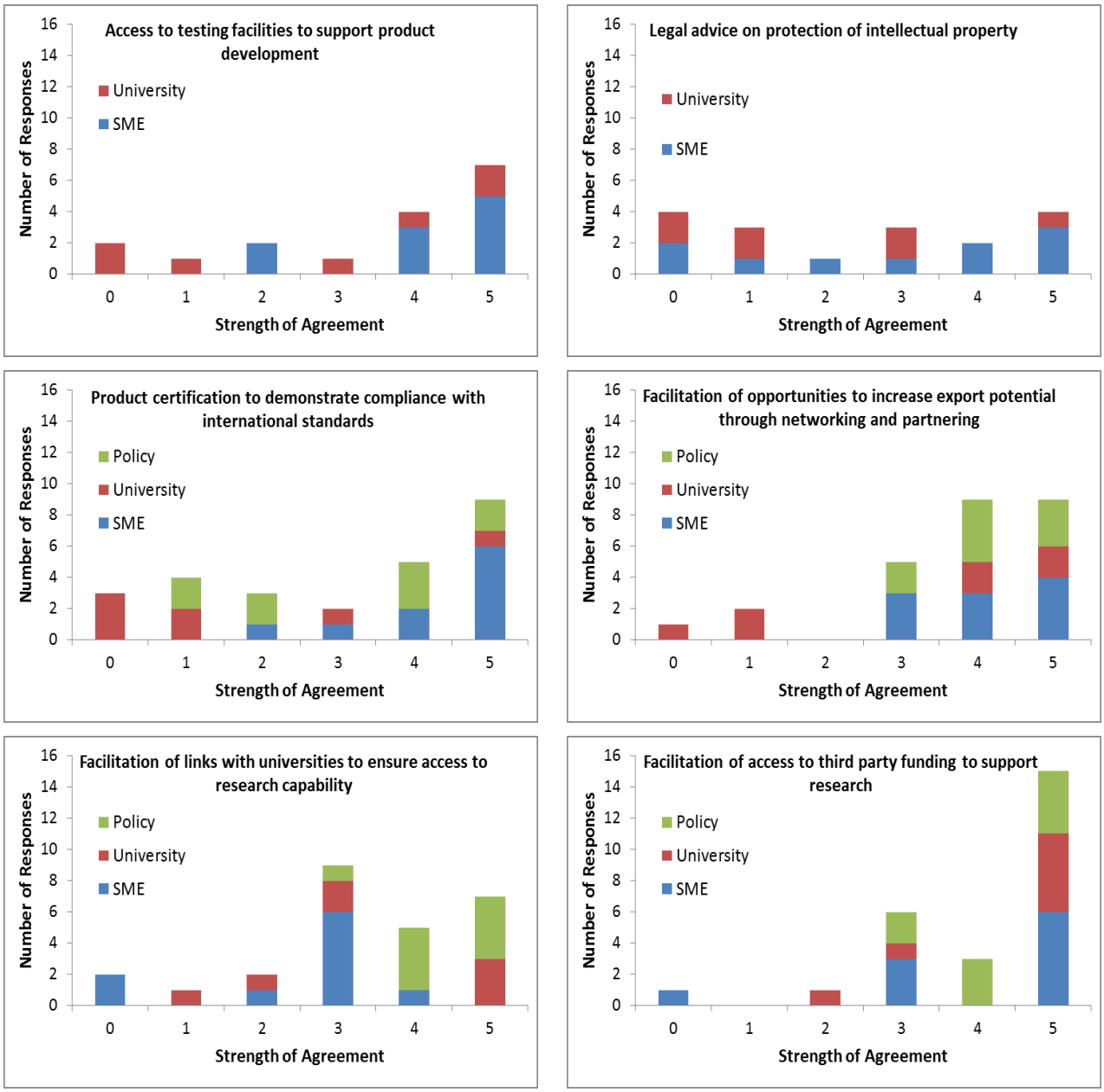
The Policy Group were asked to respond to a sub-set of the points sent to SMEs and Universities, namely:

- Product certification to demonstrate compliance with international standards;
- Facilitation of opportunities to increase export potential through networking and partnering with major engineering companies;

- Facilitation of links with universities to ensure access to their research capability and provide intelligence on future product opportunities; and
- Facilitation of access to third party funding to support research, i.e. EU and UK Research Councils.

The numerical scoring from each of these criteria is indicated in Figure 5 below.

Figure 5: Numerical Analysis of Responses from Questionnaires



In summary, responses to the questionnaire show that:

1. SMEs believe their businesses would benefit from the existence of a facility that provides:
    a. Access to testing facilities to support product development;
    b. Product certification to demonstrate compliance with international standards;
    c. Opportunities to increase export potential through networking and partnering;
    d. Access to third party funding to support research;
2. The need for advice on intellectual property protection is less pronounced;
3. Universities have an interest in facilitating access to research capability and a strong interest in facilitating access to third party research funding, but a lower requirement for access to test facilities, product certification and access to markets. These differences are not unexpected as universities commonly have access to laboratories to support research needs and there is less of a drive to develop ideas to prototype stage and to demonstrate capability to potential customers; and
4. Policy responses follow the trends of SMEs but with less emphasis on the need for demonstration of product compliance with international standards.

The majority of SME responses provided very detailed descriptions of testing needs at the level of the specialist requirements of individual businesses. The style of this response was also repeated in the descriptions of the test facilities that SMEs have available to them, which were all of a small specialist nature. However, one respondent did take the opportunity to scope out the contents of a potential test facility in some detail (Box 3).

Box 3: SME response – criteria for potential test facility

1. Access to running sewage effluent.
2. Access to surface water such as a river, if the river was grossly polluted then this would be an advantage. Systems should also be in place to modify the water in order to simulate a range of freshwater types.
3. Access to ground water, probably from different depths down to 200m. If the ground water was contaminated with iron, manganese and arsenic then this would be an advantage, but not essential. Systems should be in place to modify the water quality to produce different types of water.
4. Access to seawater, in terms of water supplies this is low in priority because it can be simulated.
5. The facility should allow for the testing of small scale systems, or products in-line on a continuous flow of real water. Successful tests can then progress to full scale evaluation on a different part of the site, but with the same feed water.
6. Full laboratory facility and training centre, e.g. – some experiments need to be carried out within 30 mins of the sample being taken;
7. Research facility for post graduate students.
8. Courses on water and wastewater treatment. For example, in Germany all swimming pool operators are trained for approx. 2 years on water treatment systems. In the UK it is 3 days. The requirement for water treatment expertise is going to grow in Scotland and on the international market.
9. Close connections with an international airport and academic institutes.

In addition to the numerical responses, relevant textual responses from members of the SME group are provided in Box 4.

Box 4: SME Responses

While partnering with major companies is useful, it is often more beneficial to work with other SMEs. The park could facilitate this exchange and cooperation. Similarly, working with engineering designers and other service providers would be useful if local. Some space should be set aside for service providers as well.

Certification to ensure compliance is essential, but international water companies / Government bodies should be involved and accept the verification / certification, otherwise the tests will need to be repeated for every company and country.

Comparative trials and evaluation of products in addition to certification would be useful.

An SME may develop to best certified product in the water industry but have great difficulty in reaching decision makers in water companies. An international dissemination network or a mechanism to open doors or place products is required.

SMEs also typically told us that, whilst they were aware of existing collaborative networks active in the broad areas of water research and innovation, the websites and other kinds of promotional material associated with these networks were too confusing, ambiguous and sometimes unhelpful (see Workshops Report, Appendix 3). SMEs frequently commented that they lacked the time to navigate the web sites that they had tried.

Universities told us that a wide range of specialist experimental testing facilities existed in that sector that could be of some value to SMEs. Further textual responses from members of the university group are provided in Box 5.

Box 5: University Responses

Developing a water and wastewater innovation park in Scotland will strengthen the Scottish capabilities to cope with the requirement of environmental pollution control and generate more opportunities for individual organisations to work together and secure research funding.

This could provide vital facilities for the development of new technologies and facilitate cross institution collaboration.

This seems, not surprisingly given the location and the members involved, far too focused on technological, downstream infrastructure responses to water problems. This really misses a huge role for the Scottish water sector in taking a much more mature and holistic approach to water and wastewater treatment in both the developed and developing world.

Given the relatively small number of responses in the policy group, it is instructive to also consider some of the textural responses from these organisations, as this may inform future engagement with a potential facility. These are provided in Box 6 and demonstrate broad support for the creation of an innovation facility in Scotland.

Box 6: Policy Responses

Scottish Water

Scottish Water has a vision to be Scotland's most valued and trusted business, and one that all Scots can be proud of. The creation of a water and wastewater innovation park would benefit Scottish Water in advancing its vision to support economic growth in the water sector through accelerating the adoption of research and innovation by stimulating collaborative working across all stakeholders. It would act as a world leading centre of excellence to showcase the capabilities across all players in the water sector, and the opportunity for more effective engagement with industry experts at an early stage to avoid wasted development effort.

It would also provide an opportunity for employee development through rotation of staff within the innovation park to facilitate knowledge transfer. The innovation facility should also offer the opportunity to test and model future environmental scenarios.

Scottish Water would welcome the creation of a "think tank" to inform future strategy and investment decisions taking account of state-of-the-art technology.

Highlands & Islands Enterprise

The water and wastewater sector has a significant role to play in helping Scotland make the transition to a low carbon economy. There is much that can be achieved by placing a spotlight on how all Scotland's key sectors use their water and deal with their wastewater, and this innovation park is therefore not just about innovation for Scottish Water.

Work undertaken by the Environmental Clean Technologies sector has highlighted that there are significant opportunities for water and wastewater technologies and other water sector capabilities in the overseas markets. Any innovation park needs to develop a strong presence and brand on an international platform and communicate Scotland's world leading and cutting edge capability as part of the Hydro Nation agenda.

The innovation park could also play a key role in connecting Tier 1 organisations with leading edge innovations – e.g. a bit like Microsoft or Apple scanning the market for new Apps for their own offerings.

Scottish Enterprise

Water is of fundamental importance for Scotland's economy, health, social wellbeing and environment. The water and wastewater innovation park would allow SMEs to assist in the development of the economic and environmental benefits from the water resources we have in Scotland. It could provide testing and verification of technologies thus stimulating innovation and accelerating access to markets. It is difficult to predict the likely impact of such a park, but it is likely to increase the academic and industry profile of Scotland nationally and internationally. This will serve to increase the economic opportunities and inward investment prospects from water in Scotland.

SEPA

Working towards a sustainable future with our stakeholders and keeping up to speed with the emerging technologies. This will enable us to understand the options and difficulties faced by those we regulate and ensure we are proportionate in regulation. It also keeps Scotland at the forefront of the issue of sustainable water management and ensures we are promoting ourselves as a centre for excellence in Europe.

Box 6 cont.: Policy Responses

Drinking Water Regulator

Scotland is a very small market for most water related products, therefore, careful consideration needs be given to the viability of such an innovation park from a supplier perspective. Also, need to avoid duplicating work or facilities available elsewhere - Scottish Water sustainable treatment for Cryptosporidium work , UKWIR and other UK water industry research and facilities.

WICS

The Water Industry Commission for Scotland, through its 'I-cubed' initiative (Incentives, Innovation and Involvement), has been promoting greater use of innovative technologies by Scottish Water. As part of this initiative we have been working to ensure that the regulatory framework encourages innovation. The proposed innovation park is therefore consistent with this shift in regulatory approach.

We would like to see far more 'piloting' of new ideas and techniques to avoid the temptation to continually resort to safe and conventional solutions. We are working with Scottish Water and the other regulators on how best to achieve this – in particular how the regulatory regime can best encourage these approaches. The innovation park could have a role in co-ordinating, monitoring and reporting on this type of activity.

We welcome the proposal as it is directionally consistent with our drive for greater innovation in the water industry. The Commission is broadly supportive of this proposal as it fits with our drive, under our 'I-cubed' initiative, for greater innovation in the industry. As ever, we are wary on costs and ensuring value for money for customers, but the partnership working of the type envisaged does appear to provide an efficient model for bringing more focus to innovation in the sector in Scotland.

5.2. Key opportunities – messages from Stakeholder Workshops

The discussions at the stakeholder workshops supported the questionnaire findings discussed above and clarified the expectations of the SME, University and Policy groups as to the purpose of the facility.

The discussions followed two themes: (i) development needs that require the facility to exist as a physical 'park':

1. Prototype scale demonstration to potential UK and international customers;
2. Comparative performance of products;
3. Testing of equipment at prototype scale;
4. Product certification;
5. Clustering of expertise in a single location to develop future opportunities;
6. Staff training and education;
7. Economic benefits to Scotland's economy/internationalisation;
8. Positioning of Scotland on the world stage;

and, (ii) networking activities that could be achieved by a virtual organisation whose role was to facilitate:

1. Access to the supply chain through the development of linkages with UK and international water utilities and other Tier 1 organisations;
2. Interaction with the water utilities to maximise opportunities for innovation;
3. Technology transfer from other sectors into the water industry; and
4. Access to third party R&D funding.

5.3. Summary – key messages from stakeholders

There is a clear body of opinion from all groups that an opportunity exists to enhance and develop water and wastewater innovation in Scotland and that this would grow the sector's share of the international export market. Based on the views of stakeholders and the nature of similar existing facilities from around the world, we believe that a fully coordinated physical 'hub and spoke' facility building on existing assets provides the best option. This would enable best use to be made of existing assets, provide a focus for water and wastewater innovation in Scotland, generate revenue and be relatively low cost.

The consolidated list of activities that it would be appropriate for an innovation centre to address is provided below. In our view, focusing on these activities would maximise the opportunities for a facility and minimise the risks and barriers to success. Further detail on these activities is provided in Section 6, but they can be summarised as:

1. Co-ordination to develop the opportunity;
2. Improving communication and visibility of the Scottish expertise and activity;
3. Developing the export market;
4. Developing the Scottish market; and
5. Supporting product innovation.

6. DEVELOPING A FACILITY - MAXIMISING OPPORTUNITIES, MINIMISING RISKS

6.1. Coordination

Given the significant activity taking place in water innovation and related areas of clean technology, co-ordination and steering will be an essential part of any future Scottish activity in this field.

We have considered whether an existing organisation such as CREW could take on this role. As indicated in Table 2 and Appendix 4, CREW's mission is to ensure policy development is supported by appropriate research. Given its current governance structure and membership, expanding this to include co-ordinating the water innovation opportunity would, we believe, require additional resource and expertise. Whilst it is clear that CREW would have a significant role to play, the nature and breadth of the activity associated with an innovation facility may require separate or additional structures to those that exist currently.

The constituency of the existing project co-ordination group includes representation of most of the bodies necessary to provide suitable advice and steering on any future project development. However, given the importance of the international export market to the

opportunity, we would recommend the addition of a member from Scottish Development International. Additionally, to ensure appropriate input on research, educational and commercial issues the group would benefit from the addition of representatives from the university and industry sector. The final make-up of the steering group should be decided once the aims and objectives of the facility are agreed.

Whilst one of the enterprise organisations could take on the lead role, it may be appropriate for this steering group to be chaired by someone from the commercial sector given the emphasis on commercialisation and product development.

Alternatively, given the importance of co-ordination, bringing together what is already being done in Scotland, and building on this to drive innovation forward, a new or dedicated organisation may be needed. Whatever the arrangement, the leadership role requires enthusiasm for the project, credibility amongst key stakeholders, knowledge of the disperse activities and facilities available, and should be undertaken by an individual or organisation with the vision to link together the key elements of the facility.

It will also be necessary to ensure clear reporting between this grouping and the evolving Hydro Nation Forum.

Recommendation 3: A water and wastewater innovation steering group should be created. Membership should be finalised once the aims and objectives of the facility are agreed, but could include the Scottish Government, Highlands and Islands Enterprise, Scottish Enterprise, Scottish Development International, Scottish Environment Protection Agency, Scottish Water and industry, together with representation from the commercial and university sectors.

Recommendation 4: Consideration should be given to this steering group being independently chaired by someone with the vision and credibility to link together the various elements of the facility and the various stakeholders, needed to ensure it will meet its strategic objectives.

To expedite the establishment of the facility and the delivery of its functions, the terms of reference for this steering group would need to be developed as soon as practicable. As well as developing the strategy for the facility and the key role around co-ordination discussed above, these should cover a number of more specific areas, which are discussed in Sections 6.2 to 6.5 below.

6.2. Communication and visibility

As we saw in Section 5, it is clear that, for SMEs in particular, enhanced communication between key stakeholders and around the main issues driving innovation in the sector would be of considerable value. Following the creation of the co-ordination group, communicating the intention and future steps to be taken will therefore be critical to success. This activity will need to be linked to developing visibility both within Scotland and internationally, through the creation of a "brand", web site and other promotional material.

Recommendation 5: The proposed steering group should consider an appropriate "brand" name for the facility, such as the acronym "WInS" (Water Innovation Scotland). It should coordinate a campaign to communicate the objectives of the facility and the creation of promotional material including leaflets and a web site.

Once objectives for the facility have been agreed, it is important that an appropriate set of metrics are devised and targets set, where practicable, to provide an objective measures of

progress against the objectives over time. These should be devised, implemented and monitored by the proposed steering group.

Recommendation 6: The steering group should devise some appropriate metrics and targets to help demonstrate progress in achieving the facility's objectives over time.

6.3. Developing the export market

There are clearly opportunities for an innovation facility to develop overseas links and to harness opportunities internationally. Indeed, many Tier One organisations active in the water and wastewater sector already operate outside the UK. In addition, Scottish Development International already operates the "Smart Exporter" scheme with Highlands and Islands Enterprise and Scottish Enterprise. This provides support for networking, strategic development, training and road shows to companies who wish to develop their international business. This therefore seems a suitable vehicle for promoting and growing the export potential of the water and wastewater industry. Water supply and wastewater treatment are already included within this scheme but are currently embedded within the Clean Technology Sector. Given the promotion of the Hydro Nation Agenda by the Scottish Government it would be appropriate to identify water and wastewater infrastructure as a sector in its own right within the scheme.

Recommendation 7: The proposed steering group should increase the profile of water and wastewater infrastructure by seeking its inclusion at the sector level within the Scottish Development International "Smart Exporter" Scheme.

6.4. Developing the domestic market

During the data gathering exercise a number of SMEs referred to the success of the water innovation network supported by Anglian Water. There are useful lessons to be learnt from this approach for a Scottish innovation facility. The important aspect of the scheme is alignment of the supply chain (large and small companies) with the needs of the water company, driven by a common objective of delivering efficient, cost-effective outcomes for customers. An important role that a facility in Scotland could play would be to develop a similar network of Tier One organisations but across a broader cross-section of water users. In our view, the industrial sector and Scottish Water would be essential participants in this network.

Recommendation 8: The proposed steering group should oversee the creation of a network of tier 1 water users within Scotland, working jointly under a common vision to develop and promote innovation in the supply chain.

6.5. Supporting product innovation

Supporting innovation requires elements of idea generation, research, laboratory testing, demonstration and verification/certification. It can arise from in-house company R&D, collaborative company based R&D or in collaboration with universities. There are a number of essential aspects of this process that the water and wastewater innovation facility should support.

1. Advice on access to funding to support R&D activities, guidance on product verification/certification and protection of intellectual property;
2. Providing access to demonstration sites;
3. Providing access to laboratories; and

4. Engagement with the Higher Education Sector.

Access to funding, product verification/certification and intellectual property

Significant funding mechanisms for water innovation exist across the portfolios of the EU and the Technology Strategy Board targeting R&D within SMEs. Examples include the EU Entrepreneurship and Innovation Programme and Europe INNOVA and the Technology Strategy Board's Proof of Market Grants (£25,000), Proof of Concept Grants (£100,000) and Development of Prototype Grants (£250,000). Other funding sources are specific to Scotland, for example SMART: Scotland, which provides grants of up to £100,000 to SMEs from Scottish Enterprise.

The issue of funding to support the development of R&D is therefore one of advice and support in seeking and advancing funding opportunities.[11] Scotland Europa already cover this area for EU funding so any co-ordination activity undertaken by a water and wastewater innovation facility would need to "dove-tail" with the existing activities of Scotland Europa. Additionally, both Highlands and Islands Enterprise and Scottish Enterprise provide support to SMEs seeking funds to support R&D, either from their own resources or by signposting other opportunities. Increasing grant support for water and wastewater R&D could therefore be achieved by linking to and co-ordinating with these opportunities, and by providing practical assistance and access to financial support.

The innovation facility could also have an influencing role to help guide and inform funding priorities at a UK and European level so that they are aligned with the needs and priorities of the end users of the technology and knowledge in Scotland.

Recommendation 9: The facility should seek to actively influence funding at national and European level to reflect its priorities, and its activities should include a R&D grant support service that "dove-tails" with the existing services offered by Scotland Europa and the enterprise organisations and that provides practical assistance and access to financial support.

Product verification and certification is a developing theme within Europe and water treatment is, for example, included within the EUs Environmental Technology Verification (ETV) pilot programme. The vision is for the ETV scheme to become self-sustaining through SMEs meeting the costs of verification by paying for verification of their products from suitably accredited laboratories. At the present time a number of existing laboratories provide an environmental technology verification service and it is likely that in future this activity will coalesce with the EU ETV scheme. The Environment Protection Agency in the USA has run such a scheme for a number of years as do other countries in the near and far East. The role of the Scottish facility would therefore be one of supporting appropriate verification processes for each technology and market sector within a co-ordination function.

[11] There are various existing sources of information regarding relevant public and private funding streams and opportunities that could be used to help establish the facility. These include Isle Consulting (2012) and an EU funding roadmap produced by the Enterprise Agencies of Scotland (http://www.enterprise-europe-scotland.com/sct/services/EU_Funding_214.asp?ContentID=0214&BackTo=0&savemsg=&CustomMessage=).

Certification is an area of key interest for many SMEs. However, there are a number of well-established facilities around the world that specialise in and offer this service. Achieving accreditation to offer certification to internationally recognised standards takes time, and it may therefore be better to work towards one site (or several sites) in Scotland being licensed to certify products and technologies that comply with existing standards.

Recommendation 10: The facility's activities should include a product verification support service; and the facility should work towards becoming a licensed certifier of compliance with internationally agreed standards.

Arranging appropriate protection of Intellectual Property is a mature issue for which Highlands and Islands Enterprise, Scottish Enterprise and others provide legal support services. This could be embedded or expanded within a co-ordination function.

Recommendation 11: The facility's activities should include an Intellectual Property protection service that draws on or supplements that already provided by steering group members.

Providing access to a demonstration sites

The creation of a bespoke facility similar to that available at the Netherlands Water Alliance would certainly provide a focal point for innovation and a physical location for those leading the support and co-ordination activities described above. The reported expenditure to create the Wetsus Campus in the Netherlands is in the region of £30 million. Clearly, to justify this level of investment, co-location of SME tenants and university researchers to the site would be an essential part of any business case.

As highlighted in recommendation 2, an alternative to the creation of a new bespoke facility would be for a single established agent (owner/operator) to act as the host for a demonstration facility (which, as discussed in Section 4.4, need not be on the same site as the facility's administrative or 'public facing' centre). A suggestion was made on a number of occasions during the data gathering exercise that Scottish Water could fulfil this role. Whilst other organisations in the industrial sector might also be willing and able, Scottish Water does have some key advantages, including its existing asset base, and the company itself suggested such an outcome in its questionnaire response. This approach would allow Scottish Water to offer real working assets in a coordinated way that would allow the demonstration of new and innovative technologies and would provide a practical step forward that could be achieved in a relatively short timescale.

The selection of a suitable site (or sites) would be critical to success; consideration would need to be given to:

1. Infrastructure costs to enable site development;
2. Providing a 'low risk' environment for testing of innovation through a collaborative approach with regulatory authorities, particularly at operational sites under licence (e.g. wastewater treatment works discharging treated effluent to the environment) where any risk of potential prosecution would need to be removed;
3. Potential for office accommodation to host staff undertaking the co-ordination function;
4. Potential to allow co-location of SMEs as users of the facility;
5. Proximity of possible university partners involved in water and wastewater innovation to provide research capability and/or CPD and training courses; and
6. Transport links.

Appropriate decisions around the locality for such a site (or sites) could enable the development of a facility similar to that in existence in the Netherlands to grow organically within Scotland through an opportunistic needs based investment strategy.

To ensure all types of demonstration need are catered for, the innovation facility could hold a register of potential sites across Scottish Water's estate that could be utilised for testing and demonstration of applicable technologies and approaches. These could either become exemplar sites or provide connection points to allow testing of products and services on specific effluent qualities or raw water source types.

Recommendation 12: The proposed steering group should consider the use of a Scottish Water site (or sites) as a demonstration site and promote a collaborative 'low risk' approach to testing.

Access to laboratory facilities

A number of organisations already seek to coordinate access to testing or demonstration facilities. For example, WRc has a database of facilities and the Scottish Environmental Technology Network (SETN), based at the University of Strathclyde, facilitates access to university laboratory facilities to support the development of clean technologies. These activities could be expanded, for example by providing a publicly accessible web site to include information on appropriate laboratory facilities available across the university sector.

From the University questionnaire responses, those universities that would appear to have the most to offer in terms of specialist equipment and facilities are Glasgow, Glasgow Caledonian, Dundee and Heriot Watt. Additionally, the facilities at the James Hutton Institute may be of value depending on the breadth of the facility's activities.

***Recommendation 13: The proposed steering group should consider how existing databases and related activities could be expanded or improved to include all laboratory and testing facilities across the whole Scottish higher education sector and beyond*.**

Engagement with the University Sector

The Energy Technology Partnership (ETP) and the Edinburgh Centre for Carbon Innovation are examples of where networks of Scottish Universities have successfully pooled their expertise to support key areas of Scottish economy. As discussed in Section 4, there is also considerable water related research in the Scottish Higher Education sector. It could provide significant support to a water and wastewater innovation facility if pooling of expertise similar to that already taking place in energy and carbon innovation also took place within the water field. The Scottish Funding Council, Scottish Enterprise and Highlands and Islands Enterprise have committed £10M to support the creation of innovation centres with precisely this objective. This would be an appropriate funding mechanism to allow the Scottish university sector to engage with the water innovation initiative in a manner that would drive innovation. The first call is now closed but we understand that a second call is planned for spring 2013.

Recommendation 14: The proposed steering group should consider recommending to the Scottish Funding Council that the creation of a Water Innovation Centre be included within their next call for proposals.

It is understood that the inclusion of such an intention in the call for proposals does not guarantee funding as all bids will require to be competitively evaluated.

7. CONCLUSIONS AND RECOMMENDATIONS

Today, there is a great deal of research in and activity around water and wastewater innovation going on in Scotland, the rest of the UK and internationally. However, we have found that there is no central focus to this activity that allows organisations, at all levels, to benefit from this in a coordinated or structured way.

In our view, there is a need and demand for a water and wastewater innovation facility in Scotland. This should build on existing processes and facilities across Scotland in an incremental and adaptive way.

Such a facility could provide a 'one-stop-shop' for organisations, particularly SMEs, to develop, test and bring to market new water and wastewater technologies, products, concepts and solutions. Importantly, it would also aid networking and facilitate more coordinated and user friendly access to information, research and funding.

There are a number of possible options for developing such a facility, including a limited expansion of existing activities, a coordinated 'hub and spoke' facility building on existing assets, and a new dedicated, centralised facility.

Based on the views of stakeholders and the nature of similar existing facilities from around the world, we believe that ***a fully coordinated 'hub and spoke' facility building on existing assets provides the best option***. This would enable best use to be made of existing assets, provide a focus for water and wastewater innovation in Scotland, generate revenue and be relatively low cost.

In order to progress the innovation facility in the most effective and timely way, we have made a number of recommendations, which are summarised in Table 6, along with broad cost estimates for their implementation. Unless otherwise noted these are annual costs and include the associated estate and overhead costs. As some of the functions relate to activities already undertaken by Highlands and Islands Enterprise, Scottish Enterprise and others, there may be cost savings were some or all of the activities absorbed within existing budget allocations.

Table 6: Summary of recommendations and potential costs

Recommendation		Resource	Cost estimate
1	We recommend that a wastewater innovation facility in Scotland aimed at filling the gaps identified in this feasibility study is justified and should be progressed. It should be focused on addressing current and future water management challenges, at home but also internationally, using a set of strategic outcome-focused objectives to direct and support innovation effort towards integrated approaches that are well co-ordinated in technical, regulatory and commercial terms between the various actors across the sector.	In-house decision	£0k

Recommendation		Resource	Cost estimate
2	We recommend that the concept of developing a brand new physical facility is not progressed at this stage on the basis that it would be difficult to justify economically. However we propose that a detailed business plan is prepared with cost-benefit analysis of investment options to extend one or more existing facilities to address the gaps identified in this feasibility study, along with potential funding streams to support a 'hub and spoke' type of approach.	One-off	£50k
3	A water and wastewater innovation steering group should be created. Membership should be finalised once the aims and objectives of the facility are agreed, but could include the Scottish Government, Highlands and Islands Enterprise, Scottish Enterprise, Scottish Development International, Scottish Environment Protection Agency, Scottish Water and industry, together with representation from the commercial and university sectors.	In-kind support	£5k
4	Consideration should be given to this co-ordination group being independently chaired by someone with the vision and credibility to link together the various elements of the facility and the various stakeholders, needed to ensure it will meet its strategic objectives.	Chair plus office support functions	£100k
5	The proposed steering group should consider an appropriate "brand" name for the facility, such as the acronym "WInS" (Water Innovation Scotland). It should coordinate a campaign to communicate the objectives of the facility and the creation of promotional material including leaflets and a web site.	Full-time appointment	£50k
6	Once established, the steering group should devise some appropriate metrics and targets to help demonstrate progress in achieving the facility's objectives over time.	Full-time appointment	£50k
7	The proposed steering group should increase the profile of water and wastewater infrastructure by seeking its inclusion at the sector level within the Scottish Development International "Smart Exporter" Scheme.	P/T appointment	£25k
8	The proposed steering group should oversee the creation of a network of tier 1 water users within Scotland, working jointly under a common vision to develop and promote innovation in the supply chain.	P/T appointment	£25k

Recommendation		Resource	Cost estimate
9	The facility should seek to actively influence funding at national and European level to reflect its priorities, and its activities should include a R&D grant support service that "dove-tails" with the existing services offered by Scotland Europa and the enterprise organisations and that provides practical assistance and access to financial support.	F/T appointment	£50k
10	The facility's activities should include a product verification support service; and the facility should work towards becoming a licensed certifier of compliance with internationally agreed standards.	Included in 9 above	
11	The facility's activities should include an Intellectual Property protection service that draws on or supplements that already provided by steering group members.	Included in 9 above	
12	The proposed steering group should consider the use of a Scottish Water site (or sites) as a demonstration site and promote a collaborative 'low risk' approach to testing.	One-off	£50k
13	The proposed steering group should consider how existing databases and related activities could be expanded or improved to include all laboratory and testing facilities across the whole Scottish higher education sector and beyond.	One-off	£30k
14	The proposed steering group should consider recommending to the Scottish Funding Council that the creation of a Water Innovation Centre be included within their next call for proposals.	Includes cost of undertaking research.	£500k

Clearly, the infrastructure costs of modifications to a Scottish Water or similar site (or sites) would depend on the choice of site, the nature of the modifications and the facilities provided, i.e. more than one access point, office accommodation for administration function and accommodation for SMEs. This is difficult to estimate without additional information and a more detailed study, but something in the range from £1 million to £5 million (one-off cost) seems appropriate.

In conclusion, the estimated potential revenue (from Section 5) of £5-10 million per year does not appear to outweigh the costs of establishing and running a brand new facility, although this is obviously very dependent on the type of facility developed and the services offered. However, a 'hub and spoke' network of facilities, with a small administrative core, does appear to be financially attractive.

In addition, factoring in the wider potential economic benefits (in terms of jobs, share of the global market, etc.) suggests that the overall impact of establishing an innovation facility is likely to overwhelmingly positive.

Figure 6 shows an initial view of how some of the key recommendations map to the key stakeholders that would need to be involved in the development of a facility in Scotland to promote water and wastewater innovation.

Figure 6: The role of key stakeholders in developing a Scottish innovation facility